

Cumulative Exposure to Lead is associated with Increased Risk of Type-2 Diabetes: the VA Normative Aging Study (NAS)

Siying Huang *Department of Environmental Health Sciences, University of Michigan School of Public Health, USA*

Sung Kyun Park *Department of Epidemiology, University of Michigan School of Public Health, USA*

Bhramar Mukherjee *Department of Biostatistics, University of Michigan School of Public Health, USA*

Huiling Nie *School of Health Sciences, Purdue University, West Lafayette, IN, USA*

David Sparrow *VA Normative Aging Study, Veterans Affairs Boston Healthcare System, Boston, MA, USA*

Howard Hu *Department of Environmental Health Sciences, University of Michigan School of Public Health, USA*

Background:

There is limited evidence of the effect of lead exposure on type-2 diabetes. Lead has high affinity for osteocalcin, and suppresses the mRNA expression of osteocalcin, which causes insulin resistance and reduced adiponectin expression. The aim of this study is to explore the potential role of cumulative lead exposure as measured in cortical bone (tibia) by K-X-ray fluorescence in the etiology of type-2 diabetes.

Method:

We examined 878 subjects who participated in the bone lead sub-study of the Normative Aging Study between 1991 and 1996. Given the decades-long half-life of tibia bone lead, we investigated development of type-2 diabetes from the baseline of the original cohort (1962-1969) through 2007 (person-years= 55,667). Diabetes status was determined from physician diagnosis, anti-diabetic medication use, fasting glucose ≥ 126 mg/dl, or two-hour glucose tolerance test ≥ 200 mg/dl. Age-adjusted tibia lead levels were categorized into high and low groups at median. Log rank test and proportional hazards (PH) model were used to examine the difference of diabetes onset age between high and low lead groups.

Result:

Of the 878 subjects at baseline, 278 subjects developed diabetes. Tibia lead levels were slightly higher in diabetics (22.9 vs. 21.1 $\mu\text{g/g}$, $p=0.07$). Log-rank test showed a significant difference in survival functions between high and low tibia lead groups ($p=0.007$). The average onset ages were 74.7 (SE=0.52) in high lead group and 80.8 (0.64) in low lead group. After controlling for age at first bone lead measurement, education, and smoking status, the PH model showed that compared to the low tibia group, the high tibia group had a 1.33 (95%CI: 1.03, 1.71) times the risk to develop type-2 diabetes.

Conclusion:

The results suggest that cumulative exposure to lead facilitates the development of type-2 diabetes. Additional research in this area is needed.